



New Hampshire Natural Heritage Inventory

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Key to Upland Forest Communities in New Hampshire

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A Quick Overview of the NH Natural Heritage Inventory's Purpose and Policies

The Natural Heritage Inventory is mandated by the Native Plant Protection Act of 1987 (NH RSA 217-A) to determine protective measures and requirements necessary for the survival of native plant species in the state, to investigate the condition and degree of rarity of plant species, and to distribute information regarding the condition and protection of these species and their habitats.

The Natural Heritage Inventory provides information to facilitate informed land-use decision-making. We are not a regulatory agency; instead, we work with landowners and land managers to help them protect the State's natural heritage and meet their land-use needs.

The Natural Heritage Inventory has three facets:

Inventory involves identifying new occurrences of sensitive species and classifying New Hampshire's biodiversity. We currently study more than 600 plant and animal species and 120 natural communities. Surveys for rarities on private lands are conducted only with landowner permission.

Tracking is the management of occurrence data. Our database currently contains information about more than 4,000 plant, animal, and natural community occurrences in New Hampshire.

Interpretation is the communication of Natural Heritage Inventory information. Our goal is to cooperate with public and private land managers to help them *protect* rare species populations and exemplary natural communities.

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Introduction

NH Heritage classifies the landscape with "natural communities," which are recurring assemblages of species found in particular physical environments. Each natural community type is distinguished by three characteristics: (1) a definite plant species composition; (2) a consistent physical structure (such as forest, shrubland, or grassland); and (3) a specific set of physical conditions (such as different combinations of nutrients, drainage, and climate conditions). Natural communities include both wetland types (e.g., red maple basin swamp) and uplands such as woodlands (e.g., rich red oak-sugar maple/ironwood talus woodland) and forests (e.g., hemlock-beech-oak-pine forest).

Across the landscape, natural communities form a mosaic of patches of different sizes. Some tend to be small (such as forest seeps) while others may cover large areas (such as montane spruce-fir forests). Further, boundaries between natural community types can be either discrete (and therefore easily identified in the field) or gradual (thus making some areas difficult to classify and map).

Classifying natural communities enables ecologists, land managers, and others to communicate effectively and to make management decisions regarding ecological systems. Community classification is a powerful tool because it provides a framework for evaluating the ecological significance of pieces of the landscape in both state and regional contexts. Understanding both the rarity of a community within the state and region and the quality of each example is critical to informed conservation planning. As landscape units that share physical and biological characteristics important to many species, natural communities help focus management and conservation attention in an efficient manner, particularly since our knowledge of the individual species in a particular community is often incomplete. In addition, use of a natural community classification can help us understand how ecological processes in one community may affect neighboring communities. For example, knowing that the surrounding upland forest soils are a primary source of nutrients flowing into a poor fen community is important information for land managers to consider when planning management activities.

The purpose of this *Key to Upland Forest Communities in New Hampshire* is to provide the user with a step-by-step way to identify natural communities in upland forest settings. The following pages include an overview of forested landscapes in the state, an explanation of how to use the key, and an index to the upland forest communities included in this document.



Overview of Forested Landscapes in New Hampshire

To provide context for understanding the rarity and significance of natural communities in New Hampshire, the following overview summarizes key characteristics of wooded landscapes (including sparse woodlands to forested uplands and wetlands) in the state.

ACIDIC UPLAND FORESTS: Acidic upland forests are common on New Hampshire's predominantly acidic, nutrient-poor soils. Acidic forests tend to be distinguished from enriched forests by the abundance of pine, spruce, hemlock, oak, or beech, which are generally less frequent in enriched settings. The concentration of rare plants and exemplary natural communities in these matrix forests is generally low, although acidic upland forests with trees greater than 150 years in age may be of interest as exemplary, old forests. Also of interest are forests with abundant white oak, scarlet oak, black oak, hickory, or other southern/Appalachian species; these communities are restricted to southern New Hampshire and contain many rare southern species that are at their northern range limits.

ENRICHED UPLAND FORESTS: Enriched forests are uncommon to rare in New Hampshire. They occur in dry to mesic settings, particularly in areas of calcium-rich bedrock and at the bases of steep slopes, where organic materials and sediments may accumulate and contribute to enrichment. While enriched forests are most frequent within approximately 30 miles of the Connecticut River, they occur in localized patches throughout the state. Enriched forests are generally dominated by tree species such as sugar maple, white ash, and basswood. Herbs that indicate strong enrichment include blue cohosh, maidenhair fern, and Dutchman's breeches; species indicative of moderate enrichment include baneberry, wood nettle, jack-in-the-pulpit, Christmas fern, alternate-leaved dogwood, red-berried elder, and ironwood (hop-hornbeam). Enriched forests also occur in the oak-hickory region of New Hampshire, which may have an abundance of southern/Appalachian species such as dogwoods or leatherwood.

TALUS SLOPES: Talus slopes are areas of coarse rock debris accumulated at the bases of cliffs, and their vegetation ranges from closed-canopy forests to open barrens, depending on talus size, degree of soil development, and level of disturbance. Acidic and enriched talus forest/woodlands and barrens are generally rare or uncommon in New Hampshire. Talus forest/woodlands can be distinguished from those on stable substrates by herb, shrub, and vine species characteristic of woodland openings, rocky areas, or disturbed habitats, such as gooseberries and currants, climbing buckwheat, poison ivy, Virginia creeper, and rock polypody.

ROCKY RIDGES: Rocky ridge communities are open rock outcrop areas typically interspersed with scattered patches of trees and heath shrubs such as low bush blueberry or huckleberry. They occur on dry, exposed summits, ridges, and other hillside bedrock outcrops with thin soils. Most types are rare in New Hampshire. Rocky ridge communities can often be identified by a combination of the landscape setting, vegetation structure, and dominant tree species, which may include jack pine, red pine, red spruce, or oak.

SAND PLAIN SYSTEMS: Sand plains are generally flat, pine-dominated systems often embedded with uncommon wetland types such as bogs or fens. Pitch pine, red pine, or white pine may be abundant in varying proportions. Forest/woodlands dominated by pitch or red pine are rare in New Hampshire.



Overview of Forested Landscapes in New Hampshire

FLOODPLAIN FORESTS: Floodplain forests occur on temporarily flooded silt, loam, and sand terraces adjacent to major and minor rivers and major streams. Most floodplain forest types are rare or uncommon in New Hampshire. Low floodplain forests associated with major rivers are typically dominated by silver or sugar maple. Floodplain and higher terrace forests along minor rivers and major streams are frequently dominated by red maple; additional dominant or codominant tree species may include swamp white oak, balsam fir, or sycamore.

FORESTED SWAMPS: Forested swamps typically occur in basin settings, seepage areas, or adjacent to rivers, streams, or lakes. Water levels are at or near the ground surface for part to much of the year. Forested swamps dominated primarily by red maple are fairly widespread in New Hampshire; rare or uncommon swamps are those with a high abundance of species such as black gum, black spruce, Atlantic white cedar, northern white cedar, black ash, or swamp white oak. Seepage conditions in forested swamps, which often support rare plants, may be indicated by species such as northern white cedar, black ash, spicebush, sensitive fern, and many wetland orchids.

FOREST SEEPS: Forest seeps are similar to larger swamps or marshes but occur as small wetland inclusions within upland forests. Groundwater is discharged at or near the soil surface, either continuously or for much of the year. Most seeps are on slopes from 1-25 degrees and are less than 0.1 acre. Functionally, seeps serve as refugia for wetland plants, amphibians, and other organisms in upland-dominated landscapes. Acidic seeps are relatively common in New Hampshire, but circumneutral or enriched seeps are uncommon or rare. Some species diagnostic of seepage include jewelweed, small enchanter's nightshade, dwarf raspberry, and golden saxifrage.



How to Use this Key

This *Key to Upland Forest Communities in New Hampshire* is designed to aid in the identification of natural communities in upland forest settings. The document is divided into three sets of keys, which should be followed in sequence. The three sets of keys include:

1. *Key to Systems:* This key helps the user determine whether a given area of vegetation occurs within an upland, freshwater wetland, tidal/subtidal, lake/pond, or stream/river zone.
2. *Key to Groups of Upland Communities:* If the study area is determined to occur in an upland setting (including floodplain forests), this key will help the user identify the major group of upland communities to which the vegetation of the area belongs. Major groups of communities addressed by this key include floodplain forests; spruce-fir forests; oak, oak-hickory, and oak-pine forests; northern and transition hardwood-conifer forests; talus woodland/barrens; alpine/subalpine communities; and rocky ridges.
3. *Keys to Communities within each Upland Forest Group:* If the study area is determined to fall within a major group of upland forest communities, these keys will help the user identify the particular natural community or communities represented. The rarity of each community within New Hampshire is indicated by the state rank, which follows each community name and is explained in Appendix 1. Appendix 2 provides a list of floodplain forest communities in New Hampshire, which are not covered in the community keys but can often be identified based on their landscape position and dominant species. The specific keys to upland forest groups include:
 - *Key to spruce-fir forest group;*
 - *Key to northern and transition hardwood-conifer forest group; and*
 - *Key to oak, oak-hickory, and oak-pine forest group.*

The sequence of keys in this document is designed to aid in the identification of systems, major groups of upland communities, and specific upland forest community types by reducing detailed differences down to a series of consecutive, dichotomous (“either-or”) decisions between two sets of characteristics. Each pair of choices (only one of which is selected for a given study area) shares the same number. The first choice in each numbered couplet is designated “a” and the second “b.” The user selects the most accurate description from the two options, and this description then leads either to another couplet (and another decision) or to a solution (a system, group of upland communities, or upland forest community type name). If variability in the composition and relative abundance of plant species sometimes makes more than one choice appropriate for different examples of a community, that community will be listed accordingly in more than one part of the key.

Many communities can be identified with only a modest familiarity with plants, but some require more botanical knowledge. If plant identification experience is limited, using the groups of communities, such as floodplain forests, talus slopes, and rocky ridges, is a way to begin understanding the diversity of landscape types that strongly influence vegetation. For uplands (including floodplain forests), the *Key to Groups of Upland Communities* will aid in the identification of these groups. For upland, freshwater wetland, and tidal/subtidal vegetation in New Hampshire, broad classes of natural communities are outlined in the companion document to the key, *Overview of Natural Communities in New Hampshire*.¹

¹ Sperduto, D.D. and K.F. Crowley. *Overview of Natural Communities in New Hampshire*. New Hampshire Natural Heritage Inventory, Department of Resources & Economic Development, Concord, NH.



Important Notes about the Key

1. This key is designed for use in relatively mature and undisturbed community examples at least one acre in size (for forests). Early successional occurrences or those significantly disturbed or manipulated by humans may be difficult to key out based solely on current vegetation, particularly for forests. In these instances, a community determination should include particular attention to late successional tree species in the understory and/or a combination of soil drainage, mineralogy, and texture characteristics and characteristics of adjacent undisturbed communities. Ideally, the vegetation being considered should be reasonably homogeneous, with no major internal variation in vegetation or environment.
2. It may be important to consult the more detailed community descriptions available at the New Hampshire Natural Heritage Inventory (NH Heritage) to confirm a community determination or to decide between two or more types.² Any given example in the field may not conform or "fit" cleanly into the concept of a single community type, since descriptions are based on information from a limited number of samples. Community types are essentially descriptions of discrete segments of the continuous gradient of vegetation and environmental conditions that exist on the ground, and it is often preferable to think of any one example as *approximating* one type or even more than one type, rather than "forcing" it into one category or another.
3. Community types are not synonymous with tree canopy cover types. Although there is a reliance on tree canopy species in certain sections of the key, and to some extent in the naming of the community types, they are *not* simply cover types. When trees are used for names, they generally reflect mid- to late-successional composition, but understory species have also been considered in differentiating and describing the types. Overstory composition may correlate closely with the natural community type, but this is not always the case. For instance, a white pine cover type could correspond to one of several community types. On the other hand, some cover types may be specific to a community but not be the only cover type possible for that community.
4. Species composition and relative abundance are used in various combinations to differentiate communities. The relative abundance of a species or group of species can be, but is not always, an important determinant of a community type. *Differential species* are any species used to distinguish between two community types or groups of communities. A particular species may occur in many community types, but it is used as a *differential* species only when it has diagnostic value for deciding between two *particular* community types or groups of communities. For instance, white ash and basswood are among the differential species used to decide between acidic and enriched northern hardwood forest types, but they have relatively little diagnostic value when differentiating among several types of enriched hardwood forests. In some cases, differential species may only be present in low abundance (*e.g.*, <1% cover), but still have a diagnostic value.

Characteristic species are those that often occur in a particular community, and collectively help characterize the type; however, they may not be useful as differential species when they occur in many community types.

² The classification of natural communities presented in this key follows:

Sperduto, D.D. 2000a. *A Classification of Wetland Natural Communities in New Hampshire*. New Hampshire Natural Heritage Inventory, Department of Resources & Economic Development, Concord, NH; and Sperduto, D.D. 2000b. *Natural Communities of New Hampshire: A Guide and Classification, Draft*. New Hampshire Natural Heritage Inventory, Department of Resources & Economic Development, Concord, NH.





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KEY TO SYSTEMS

1a. Rooted vegetation present.....2

- 2a. Communities on moderately well to excessively well drained, non-hydric soils that are never flooded or are only temporarily flooded river terraces (floodplain forests), lacking wetland (hydrophytic) vegetation. *Common diagnostic upland vegetation* includes: beech, red oak, white oak, hickories, white ash, white pine, red pine, pitch pine, hemlock (usually), low bush (early low) blueberry, wild sarsaparilla, starflower, Indian cucumber-root, wintergreen, New York fern, bracken fern, and intermediate wood fern. *Common floodplain forest indicators*: silver maple, red maple, sugar maple, American elm, white ash, green ash, sycamore, box elder, eastern cottonwood, black cherry, river birch, swamp white oak, musclewood (*Carpinus caroliniana*), ostrich fern, sensitive fern, lady fern, nettles, tall meadow rue, Jack-in-the-pulpit, spotted touch-me-not, rough-leaved goldenrod, Canada germander, sessile-leaved bellwort, and an abundance of vines including poison ivy.

UPLANDS, INCLUDING FLOODPLAIN FORESTS (TERRESTRIAL SYSTEM)

.....KEY TO GROUPS OF UPLAND COMMUNITIES

- 2b. Communities on saturated to somewhat poorly drained soils or regularly inundated organic or mineral soils (hydric), and supporting wetland (hydrophytic) vegetation. Low floodplain forests may be hydric or non-hydric, but are addressed in the terrestrial system key. Communities may only be inundated seasonally for restricted periods, but support wetland vegetation and soils.....3

- 3a. Plants subjected to diurnal or periodic tidal inundation (subtidal and tidal habitats). Halophytic (salt-loving) vegetation present such as cordgrasses, widgeon grass, salt marsh rush, arrow grass, narrow-leaved cattail, stout bulrush, and glassworts.

TIDAL AND SUBTIDAL ZONES (ESTUARINE SYSTEM)³

- 3b. Fresh water wetlands not influenced by tidal inundation. Common diagnostic emergent vegetation includes: cinnamon fern, winterberry, high bush blueberry, speckled alder, buttonbush, cattail, tussock sedge, bulrushes, reed grass, peat mosses, northern and Atlantic white cedar, black gum, black ash, black spruce, and leatherleaf. Common diagnostic aquatic-bed plants include: yellow water lily, pond lily, pondweeds, pickerelweed, duckweed, and bur-reed.

WETLANDS (PALUSTRINE SYSTEM)³

1b. Rooted vegetation absent; shallow to deep water aquatic environments of lakes and rivers.4

- 4a. Aquatic lake and pond settings.

LAKES AND PONDS (LACUSTRINE SYSTEM)³

- 4b. Aquatic river and stream settings.

RIVERS AND STREAMS (RIVERINE SYSTEM)³

³ Communities in this system are not addressed in this document. See the companion document, *Overview of Natural Communities in New Hampshire*, for more information on this system.



KEY TO GROUPS OF UPLAND COMMUNITIES

(Including floodplain forests)

- 1a. Tree canopy cover generally >60%. Also includes some forest/woodland communities (tree canopy cover 25-60%) on talus slopes2

FORESTS

- 2a. Communities on silt and sand terraces adjacent to major and minor rivers and major streams; subjected to regular or predictable flooding from overbank flow. Tree and shrub species often in floodplain forests: silver maple, red maple, sugar maple, American elm, white ash, green ash, sycamore, box elder, eastern cottonwood, black cherry, river birch, swamp white oak, and musclewood (*Carpinus caroliniana*). Other common floodplain forest indicators: ostrich fern, sensitive fern, lady fern, nettles, tall meadow rue, Jack-in-the-pulpit, spotted touch-me-not, rough-leaved goldenrod, Canada germander, sessile-leaved bellwort, and an abundance of vines including poison ivy.

FLOODPLAIN FOREST GROUP⁴

- 2b. Communities on moderately well to excessively well drained soils that are never regularly flooded (non-hydric soils); silver maple, eastern cottonwood, green ash, American elm, river birch, and swamp white oak generally absent.3

- 3a. Spruce and fir are the primary mid- to late-successional dominants; hemlock, sugar maple, and beech are generally absent.

SPRUCE-FIR FOREST GROUP..... PAGES 5, 6

- 3b. Hardwoods (sugar maple, beech, yellow birch, oaks), hemlock, or pine constitute the primary dominants4

- 4a. Oak and/or pines present in quantity; canopy and/or understory woody regeneration dominated by a combination of oaks and other transition hardwoods (black birch, black cherry), hemlock, white pine, or hickories. Forests with oak but heavily dominated by beech or hemlock are covered in alternate choice (4b).

OAK, OAK-HICKORY, AND OAK-PINE FOREST GROUP..... PAGES 11-15

- 4b. Oak and/or pines sparse or absent; canopy and/or understory woody regeneration dominated by a combination of northern hardwoods (sugar maple, beech, yellow birch, white ash) *with or without hemlock*; and successional hardwoods are primarily red maple, paper birch, pin cherry, striped maple, and mountain maple; *OR* if oak and/or pines are present in quantity, then hemlock or beech constitutes >75-80% of the canopy, with other species of northern and transition hardwood forests potentially present in low abundance.

NORTHERN AND TRANSITION HARDWOOD-CONIFER FOREST GROUP..... PAGES 7-10

⁴ Appendix 2 contains a list of forested floodplain communities in New Hampshire. Keys to floodplain forest, talus woodland/barren, alpine/subalpine, and rocky ridge communities are not included in this document. See the companion document, *Overview of Natural Communities in New Hampshire*, for additional information about these groups.



KEY TO GROUPS OF UPLAND COMMUNITIES (Including floodplain forests)

- 1b. Tree canopy cover generally <60%. **5**

WOODLANDS AND BARRENS

- 5a. Communities occur on talus slopes (areas of coarse rock debris accumulated at the base of cliffs, although the original cliff may no longer be evident); tree canopy cover generally >25%, potentially interspersed with open patches disturbed by rock fall, rock movement, avalanches, and/or windthrow. Talus woodland/barrens with a significant forested component are addressed in the keys to forests groups.

TALUS WOODLAND/BARREN GROUP⁴

- 5b. Communities do not occur on talus slopes; extensive areas are open, with tree canopy cover <25% **6**

- 6a. Open communities at high elevations; above treeline.

ALPINE/SUBALPINE GROUP⁴

- 6b. Open rock outcrop areas interspersed among a patchy or scattered tree overstory; below treeline.

ROCKY RIDGE GROUP⁴





KEY TO SPRUCE-FIR FOREST GROUP

- 1a. Black spruce and pines scattered or absent. 2

- 2a. Balsam fir dominates; trees generally less than 10 m in height; usually 3500-4500 ft. elevation, or lower in exposed settings and higher in protected ravine settings; red spruce, yellow birch, and paper birch absent or in relatively low abundance (heartleaf birch more prominent); low elevation balsam fir flats correspond to lowland spruce-fir forest (below).

High-elevation balsam fir forest (S3S4)

- 2b. Red spruce or red spruce and balsam fir are among dominants; heartleaf and/or paper birches, yellow birch, and mountain ashes may be common.

- 3a. Till soils or stabilized, heavily forested small- to moderate-sized talus with no or few patches of open talus interspersed; mountain maple and rock polypody may be present, but frequent dense patches on boulders absent; gooseberries and currants, climbing buckwheat, common hair-grass (*Deschampsia flexuosa*), Rand's goldenrod, Virginia creeper, and other open rocky-site species sparse or absent. 4

- 4a. Heartleaf birch, yellow birch, and mountain ash often present in quantity; most common above 2,500 ft. elevation, but can occur at lower elevations on poor soils on mountain side slopes; generally not in valley bottom settings.

High-elevation montane spruce-fir forest (S4)

- 4b. Generally less than 2500 ft elevation in valley bottom settings (till soils, river terraces, or on gentle, low elevation valley side slopes; various combinations of white or black spruce may be present, but heartleaf birch is infrequent or absent.

Lowland spruce-fir forest (S2S3)

- 3b. Forest or woodland on unstable and/or moderate to large talus; frequent dense patches of mountain maple and rock polypody common; open rocky-site species usually present in open or woodland talus patches such as gooseberries and currants (*Ribes* spp.), climbing buckwheat, common hair-grass (*Deschampsia flexuosa*), Rand's goldenrod, and Virginia creeper; occurrences in deep ravines or on huge, shaded talus with black spruce, naked miterwort and boulders festooned with mosses, liverworts and rock polypody, may indicate a rare to uncommon "cold-air talus" variant (S1).

Spruce-birch/mountain maple talus forest/woodland (S3)



KEY TO SPRUCE-FIR FOREST GROUP

- 1b. Black spruce or pines present in abundance5
- 5a. Steep talus settings or bases of talus slopes.....6
- 6a. Large boulder talus in deep gulches or at bases of large talus slopes; extreme micro-climate produced by cold-air drainage or late-melting ice influence; supports subalpine plants at moderately low elevation (2300-3400 ft); black spruce and/or red spruce frequent with subalpine plants such as black or purple crowberries, alpine bilberry, mountain cranberry, and dwarf shrubs including sheep laurel, rhodora, creeping snowberry, and velvet-leaved blueberry. Mostly woodland and barren structure but may be forested in some areas or associated with spruce/birch talus forest.
- Subalpine cold-air talus woodland/barren (G3 S1)**
- 6b. Cold-air micro-climate may be significant but not extreme enough to support subalpine plants; variably-sized talus; black spruce and red spruce present, with lush carpets of mosses, liverworts, and rock polypody on talus boulders.
- Spruce-birch/mountain maple talus forest/woodland, cold-air variant (S1)**
- 5b. Not on talus slopes7
- 7a. Black spruce abundant and usually codominant with red spruce; heath shrubs and other dwarf shrubs common, including sheep laurel, Labrador tea, bunchberry dogwood, creeping snowberry; imperfectly drained silty soils at high elevations in mountains (>2500 ft.); may occur at lower elevations north of White Mountains.
- Montane black spruce-red spruce forest (S1)**
- 7b. Black spruce absent or rare; white and/or red pine present in abundance; red oak and pitch pine may be present also; balsam fir is abundant in the overstory or understory; mesic to dry-mesic sandy soils or cold-air drainage positions (e.g., valley bottoms) in central and possibly northern NH (Ossipee, Barnstead).
- Red pine-white pine-balsam fir forest (S3)**



KEY TO NORTHERN AND TRANSITION HARDWOOD-CONIFER FOREST GROUP

- 1a.** *Sugar maple is abundant or the only dominant in the canopy along with 2 or more of the following enriched-site indicator species: blue cohosh, ostrich fern, maidenhair fern, sweet cicely, Dutchman's breeches, baneberry, foamflower, hepatica, wood nettle, round-leaved violet, jack-in-the-pulpit, zig-zag goldenrod, ginseng, alternate-leaved dogwood, basswood, or white ash; hemlock usually not present in quantity. If oak is present, use the Key to Oak, Oak-Hickory, and Oak-Pine Forest Group* **2**

ENRICHED FORESTS

- 2a.** *One or more of the following rich mesic forest differential species is present (absent in semi-rich mesic forests): blue cohosh, ostrich fern, maidenhair fern, sweet cicely, Dutchman's breeches, silvery spleenwort, or Goldie's fern; usually a broad (but variable) diversity of enriched site species are also present, including some listed for alternate choice (2b); beech infrequent or absent (sugar maple is almost always more abundant).*

Rich mesic forest (S3)

- 2b.** *Species above absent or essentially so; species indicative of only moderately enriched conditions are present, as indicated by the presence of two or more of the following: baneberry, foamflower, wood nettle, round-leaved violet, jack-in-the-pulpit, zig-zag goldenrod, Christmas fern, alternate-leaved dogwood, basswood or white ash, red-berried elder, wild millet, ironwood (*Ostrya virginiana*), and Braun's holly fern; diversity and abundance of these enriched-site species is generally low compared to that of alternate choice (2a); sugar maple dominates, although beech may be codominant, and yellow birch may present; forests of till, talus, and river terrace-flat landscape positions*..... **3**
- 3a.** *Hardwood forests of low to mid elevations (less than 1600-1800 ft.); modest percent cover of herbs and ferns; species of alternate choice (3b) generally in low abundance and frequency compared to high elevation examples.*

Semi-rich mesic sugar maple-beech forest (S3S4)

- 3b.** *Hardwood forests of moderately high elevations (>1600-1800 ft., ranging to 2600 ft.), generally with lush understory (high percent cover) of ferns and herbs; clintonia (blue-bead lily), shining clubmoss, mountain wood fern, intermediate wood fern, slender or drooping woodreed (*Cinna latifolia*), inflated sedge (*Carex intumescens*), and/or lady fern often abundant.*

Rich mesic or semi-rich mesic forests, high elevation variant (S1S2)



KEY TO NORTHERN AND TRANSITION HARDWOOD-CONIFER FOREST GROUP

- 1b. Above indicator species absent or very sparse; overstory dominants include various combinations of sugar maple, beech, yellow birch, red maple, spruce, and/or hemlock; ash and basswood absent or scattered.4

ACIDIC, PRIMARILY NUTRIENT-POOR FORESTS

- 4a. Community with more than 5-10% of the tree canopy (or of the likely late-successional dominants evidenced in the understory) consisting of red spruce or balsam fir, *OR* nearly entirely dominated by yellow birch.....5

- 5a. Forest or woodland on unstable and/or moderate to large talus; frequent dense patches of mountain maple and rock polypody common; open rocky-site species usually present in open or woodland talus patches, such as gooseberries and currants (*Ribes* spp.), climbing buckwheat, common hair-grass (*Deschampsia flexuosa*), Rand's goldenrod, and Virginia creeper. Occurrences in deep ravines or on huge, shaded talus with black spruce, naked miterwort, and boulders festooned with mosses, liverworts and rock polypody may indicate a rare to uncommon "cold-air talus" variant (S1).

Spruce-birch/mountain maple talus forest/woodland (S3)

- 5b. Till soils or stabilized, heavily forested, small- to moderate-sized talus with no or few patches of open talus interspersed; mountain maple and rock polypody may be present, but frequent dense patches on boulders absent; gooseberries and currants, climbing buckwheat, hair-grass, Rand's goldenrod, Virginia creeper, and other open rocky-site species sparse or absent.....6
- 6a. Various combinations of sugar maple, beech, and yellow birch, mixed with a significant but often minority component of spruce and fir; *hemlock absent*; found primarily on upland till soils above 2000 ft. elevation; some examples may be dominated by yellow birch.

Northern hardwood-spruce-fir forest (S4)

- 6b. Hemlock and spruce present in abundance with or without mixtures of northern hardwoods (maples and birches); found on upland till soils, and sloping and flat areas of river and kame terrace soils.

Hemlock-spruce-northern hardwood forest (S3S4)

- 4b. Spruce and fir consist of <5-10% of the canopy (or of the likely late-successional dominants evidenced in the understory); not dominated by yellow birch.7
- 7a. Hemlock constitutes >75-80% of the canopy.8

- 8a. Imperfectly to somewhat poorly drained soils of river terraces and drainageways with a combination of moist and wet site ferns and herbs (cinnamon, marsh, New York, and Clayton's ferns, Jack-in-the-pulpit, and/or abundant ground-mosses, etc.).

Low hemlock-hardwood/cinnamon fern forest (S4?)

- 8b. Well to moderately well drained hemlock forests with sparse understory of common, moist upland forest species (starflower, partridge-berry, etc) with very few if any wetter site species such as cinnamon fern.

Hemlock forest (S4)



KEY TO NORTHERN AND TRANSITION HARDWOOD-CONIFER FOREST GROUP

- 7b. Otherwise. 9
- 9a. Beech constitutes >75-80% of the canopy (or of the likely late-successional dominants as evidenced by woody understory regeneration); low diversity and abundance of herbaceous understory plants.
Beech forest (S4?)
- 9b. Beech constitutes <75-80% of the canopy..... 10
- 10a. Hemlock absent or present in low abundance (<5-10% of canopy or woody understory); sugar maple, beech, yellow birch, red maple, and lesser quantities of ash and other hardwoods dominate. 11
- 11a. *Beech, sugar maple, and yellow birch* comprise the dominant mid-late successional canopy and/or woody understory species; pin cherry, red maple, striped maple, mountain maple, hobble bush may be present in the understory or as seral species; the following "*northern hardwood*" *herb species tend to be more frequent and abundant* than in alternate choice (11b): *wood sorrel, shining clubmoss, blue-bead lily, twisted stalk, and mountain wood fern (Dryopteris campyloptera)*; witch hazel and wintergreen are largely absent or sparse, and other herbs of 11b are infrequent.. 12
- 12a. Forests of river terrace soils with somewhat enriched conditions as evidenced by presence of abundant sessile-leaved bellwort, and occasional wakerobin (red trillium), alternate-leaved dogwood, hazlenut, white ash, and Jack-in-the-pulpit.
Semi-rich mesic sugar maple-beech forest (S3S4), sugar maple-yellow birch-white ash/hazelnut-dogwood terrace flat variant
- 12b. Classic "northern hardwood" forest; usually on fine till soils or those of river terraces but not as described above (sessile-leaved bellwort or other *Trillium* species may be present, but the semi-rich differential species are generally absent).
Sugar maple-beech-yellow birch forest (G5 S5)
- 11b. "Transition hardwood" forests, with only *minor (or no) sugar maple and yellow birch* presence; beech, black birch, red oak, red maple, black cherry, paper birch, white pine, and hemlock all may be present in various combinations; *witch hazel, wintergreen, maple-leaved viburnum, Indian cucumber-root, clubmosses other than shining clubmoss, and New York fern are generally more frequent and more abundant* than in northern hardwoods (11a); northern hardwood herbs such as wood sorrel, shining clubmoss, blue-bead lily, and twisted stalk are infrequent or absent; numerous species are common to both choices (11a and 11b) such as wild sarsaparilla, starflower, sessile-leaved bellwort, and Canada mayflower.
Hemlock-beech-oak pine forest (phase without hemlock or pine prominence) (S5)



KEY TO NORTHERN AND TRANSITION HARDWOOD-CONIFER FOREST GROUP

- 10b.** Hemlock present in modest to considerable abundance (>5-10% of canopy or understory late successional species).**13**

- 13a.** As described for **11b**, but hemlock quite abundant; wide variety of cover types is apparent within this broadly defined type; a very common community throughout NH generally below 1400 ft. elevation; variant with abundant mountain laurel in the understory included here.

Hemlock-beech-oak pine forest (S5)

- 13b.** Hemlock in abundance with more northern hardwood canopy (beech, yellow birch, sugar maple, etc), and herbaceous species present as described for **11a**; red oak, white pine, and herbs of transition hardwood forests largely absent.....**14**

- 14a.** Low, imperfectly drained areas (low river terraces or drainageways) with seasonally high water tables (but not wetlands) with various combinations of hemlock, red maple, yellow birch, occasional white ash, *AND* wetter-site species such as cinnamon fern, interrupted fern, Jack-in-the-pulpit, marsh fern, spicebush, and violets.

Low hemlock-hardwood/cinnamon fern forest (S4?)

- 14b.** Moderately well to well drained areas (although generally mesic) without wetter-site species above.

Hemlock-beech-northern hardwood forest (S4)



KEY TO OAK, OAK-HICKORY, AND OAK-PINE FOREST GROUP

- 1a. Nutrient rich forest communities (rich or semi-rich); pitch pine, red pine, abundance of heath shrubs are *absent*; 3 or more of the following species present: sugar maple, white ash, basswood, ironwood, butternut, foamflower, round-leaved violet, Christmas fern, maidenhair fern, blue cohosh, baneberry, hepatica, Virginia waterleaf, Jack-in-the-pulpit, alternate-leaved dogwood, ebony spleenwort (*Asplenium platyneuron*), any woodsia ferns, herb-Robert, wide-leaved sedges, and blackseed rice-grass (*Oryzopsis racemosa*); poison ivy often present in abundance. 2

ENRICHED OAK AND OAK-HICKORY COMMUNITIES

- 2a. Dry and/or extremely rocky slopes (dry to dry-mesic), including talus slopes; some species overlap with next group; ironwood (*Ostrya virginiana*) tends to be more abundant; indicators of rocky and/or dry-rich conditions include ebony spleenwort (*Asplenium platyneuron*), rusty woodsia, rock-cresses (*Arabis* spp.), herb-Robert, wild currant (*Ribes* spp.), columbine, marginal wood fern, rock polypody, and “grassy lawns” of Pennsylvanian sedge (*Carex pensylvanica*). 3
- 3a. Primarily dry enriched forests on shallow sloped till soils (mostly somewhat rocky, middle to upper slopes) with various oaks, hickories, and/or ironwood in the overstory; ebony spleenwort is often present but sparse, along with such species as rusty woodsia, blunt-lobed woodsia, sicklepod, late purple aster, and four-leaved milkweed; sugar maple and ash are often present but less abundant; diagnostic species of rocky talus slopes listed below (13b) are absent or less common.

Dry rich Appalachian oak-hickory forest (S1)

- 3b. Enriched talus forests (or rocky till forest with colluvial influence); generally dry-mesic; usually dominated by red oak and sugar maple; basswood and butternut occasional; herb-Robert, blackseed rice-grass (*Oryzopsis racemosa*), marginal wood fern, Virginia creeper, wild currant (*Ribes* spp.), false-solomon's seal, round-leaved dogwood, poison ivy, rock polypody, common hair-grass (*Deschampsia flexuosa*), beaked hazelnut, and yellow birch are frequently present in quantity. 4
- 4a. Hickory, Appalachian oaks (white oak, black oak, scarlet oak), flowering dogwood, or other species that reach the north end of their range in southern NH are present; southern and coastal NH, usually < 500 ft. elevation, but potentially up to 1000 ft. elevation.

Rich Appalachian oak-hickory talus forest/woodland (S1)

- 4b. Hickories, Appalachian oaks, flowering dogwood, and other species that reach the north end of their range in southern NH are absent; among oaks, only red oak present; central and southern NH and south slopes of White Mountains; generally less than 1200 ft. elevation, but potentially up to 1800 ft.

Rich red oak-sugar maple/ironwood talus forest/woodland (S2S3)



KEY TO OAK, OAK-HICKORY, AND OAK-PINE FOREST GROUP

- 2b. Not dry and not extremely rocky (but some rocks may be present); dry-mesic to mesic till or terrace slopes and flats; species in alternate choice (2a) sparse or absent.5

- 5a. Rich forests on fine sediments of river terrace slopes or flat high floodplain terraces (including silty glacial lakebed sediments); moderately high to high tree diversity, potentially including oaks, maples, usually hickories, ash, basswood, hemlock, ironwood (*Ostrya virginiana*), musclewood (*Carpinus caroliniana*), and birches; understory species often include ostrich fern, Virginia creeper, dogtooth violet (trout lily), scouring rush (*Equisetum* spp.), maidenhair fern, and hepatica.

Rich sugar maple-ash-oak-hickory forest (S1)

- 5b. Semi-rich forests generally on till soils or coastal marine sediments; tree diversity may be low to moderately high; lower diversity of rich-site indicators; 2 or more semi-rich herbaceous indicators present such as foamflower, round-leaved violet, Christmas fern, baneberry, naked tick-trefoil, and poison ivy; indicators of rich conditions are absent (e.g., maidenhair fern, blue cohosh, and Dutchman's breeches).6

- 6a. Appalachian oaks or hickories present; coastal and southern NH; less than 800 ft elevation.

Semi-rich Appalachian oak-sugar maple forest (S2S3)

- 6b. Appalachian oaks or hickories absent; tree diversity often lower, composed primarily of sugar maple, beech, and oak; mostly south-central to northern NH up to approximately 1600 ft elevation.

Semi-rich mesic sugar maple-beech forest (S3S4)



KEY TO OAK, OAK-HICKORY, AND OAK-PINE FOREST GROUP

- 1b. Nutrient rich indicator species noted in alternate choice (1a) absent or very sparse; generally less than 3 of noted species present. 7

DRY TO MESIC OAK AND PINE FORESTS WITH ACID-TOLERANT PLANTS

- 7a. Appalachian oaks (white, scarlet, or black), mountain laurel or other southern/Appalachian species form a significant presence along with the hemlock, beech, pine, and red oak; pitch pine absent or sparse. 8

APPALACHIAN HARDWOOD-CONIFER FORESTS

- 8a. Talus slopes; acidic to merely weakly enriched; species indicative of or more abundant on talus slopes include marginal wood fern, false-Solomon's seal, rock polypody, and vines (including climbing buckwheat, poison ivy, Virginia creeper, bittersweet).

Red oak-hickory-black birch/marginal wood fern talus forest/woodland (S1S2)

- 8b. Not on talus slopes; above indicator species sparse or absent. 9

- 9a. Mountain laurel abundant.

Appalachian oak-hemlock-black birch/mountain laurel forest (S3)

- 9b. Mountain laurel sparse or absent 10

- 10a. Species more restricted to dry sites typically frequent or abundant, such as low bush (early low) blueberry, whorled loosestrife, Pennsylvanian sedge (*Carex pensylvanica*), and/or common hair-grass (*Deschampsia flexuosa*).

Dry Appalachian oak-hickory forest (S3)

- 10b. Species more indicative of dry sites (in alternate choice (10a)) absent or in low abundance. 11

- 11a. Species more indicative of mesic or silty soil conditions more abundant, including red maple, white ash, black cherry, sugar maple, American elm, ironwood (*Ostrya virginiana*), poison ivy, buckthorn (*Rhamnus* spp.), Jack-in-the-pulpit; wet site species may be scattered such as high bush blueberry and cinnamon fern; silt loam to very fine sandy loams typical.

Mesic Appalachian oak-hickory forest (S2S3)

- 11b. Species indicative of mesic or silty soils (11a) absent or less abundant; species indicative of dry to dry-mesic conditions relatively more abundant (hickories, black oak, white oak, beech, paper birch); sandy loam soils typical.

Dry-mesic Appalachian oak-hickory forest (S3S4)



KEY TO OAK, OAK-HICKORY, AND OAK-PINE FOREST GROUP

- 7b. Appalachian oaks and other southern species sparse or absent; *OR* if southern species present in quantity, pitch pine also abundant.12

TRANSITION HARDWOOD-CONIFER FORESTS WITH OAK OR PINE

- 12a. Talus slopes; acidic to merely weakly enriched; species indicative of or more abundant on talus slopes include marginal wood fern, false-Solomon's seal, rock polypody, and vines (including climbing buckwheat, poison ivy, Virginia creeper, bittersweet).

Red oak-black birch/marginal wood fern talus forest/woodland (S3S4)

- 12b. Not on talus substrate; talus indicators sparse or absent.13

- 13a. Mesic and dry-mesic oak and/or pine forests with considerable hemlock, beech, sugar maple, yellow birch, black cherry, black birch, balsam fir, mountain laurel, or other mesic to dry-mesic site species present in the overstory or understory; dry site species of alternate choice (13b) less abundant, sparse, or absent14

- 14a. Balsam fir or spruce present in abundance in overstory or understory; red pine, white pine, and/or red oak are dominant or codominant.

Red pine-white pine-balsam fir forest (S3)

- 14b. Balsam fir or red spruce absent

Hemlock-beech-oak-pine forest (S5)

- 13b. Dry oak and/or pine forests with above species sparse or absent; oak and pine tend to dominate, and may include white, scarlet, or black oak where pitch pine is also present; acidic dry site species abundant or dominant, including such species as low bush (early low) blueberry, dangleberry or huckleberry, sweet fern, bracken fern, whorled loosestrife, maple-leaved viburnum, "lawn"-forming Pennsylvanian and woodland (distant) sedges (*Carex pensylvanica/lucorum*), common hair-grass (*Deschampsia flexuosa*), rough-leaved rice-grass (*Oryzopsis asperifolia*), poverty grass (*Danthonia spicata*), and pinweed.....15



KEY TO OAK, OAK-HICKORY, AND OAK-PINE FOREST GROUP

- 15a.** Red or pitch pine present in quantity (generally >5-10%)..... **16**
- 16a.** Red pine is the primary or sole dominant.
Red pine forest/woodland, forest phase (S2)
- 16b.** Red pine present in low abundance, if at all..... **17**
- 17a.** Pitch pine is primary or sole dominant and is accompanied by scrub oak.
Pitch pine/scrub oak forest/woodland, forest phase (S1S2)
- 17b.** Otherwise. **18**
- 18a.** Pitch pine is present in quantity along with red oak and Appalachian oaks (white, scarlet, or black); scrub oak may be present, and heath shrubs are common.
Pitch pine-Appalachian oak/heath forest (S1)
- 18b.** Appalachian oaks are sparse or absent; pitch, red, and white pines are generally present along with red oak and heath shrubs.
Pitch-red-white pine-red oak/heath forest/woodland (G3G4 S1)
- 15b.** Red oak and/or white pine dominates on dry sites, with little or no pitch or red pine; some examples may have ironwood, lawns of Pennsylvanian sedge (*Carex pensylvanica*), or abundant heath shrubs.
Dry red oak-white pine/heath/bracken fern forest (S3S4)



Appendix 1. Explanation of global and state rank codes.

Ranks describe rarity both throughout a species' range (globally, or "G" rank) and within New Hampshire (statewide, or "S" rank). The rarity of sub-species and varieties is indicated with a taxon ("T") rank. For example, a G5T1 rank shows that the species is globally secure (G5) but the sub-species is critically imperiled (T1).

Code Examples Description

1	G1	S1	Critically imperiled because extreme rarity (generally one to five occurrences) or some factor of its biology makes it particularly vulnerable to extinction.
2	G2	S2	Imperiled because rarity (generally six to 20 occurrences) or other factors demonstrably make it very vulnerable to extinction.
3	G3	S3	Either very rare and local throughout its range (generally 21 to 100 occurrences), or found locally (even abundantly at some of its locations) in a restricted range, or vulnerable to extinction because of other factors.
4	G4	S4	Widespread and apparently secure, although the species may be quite rare in parts of its range, especially at the periphery.
5	G5	S5	Demonstrably widespread and secure, although the species may be quite rare in parts of its range, particularly at the periphery.
U	GU	SU	Status uncertain, but possibly in peril. More information needed.
H	GH	SH	Known only from historical records, but may be rediscovered. A G5 SH species is widespread throughout its range (G5), but considered historical in New Hampshire (SH).
X	GX	SX	Believed to be extinct. May be rediscovered, but evidence indicates that this is less likely than for historical species. A G5 SX species is widespread throughout its range (G5), but extirpated from New Hampshire (SX).

Modifiers are used as follows.

Code Examples Description

Q	G5Q	GHQ	Questions or problems may exist with the species' or sub-species' taxonomy, so more information is needed.
?	G3?	3?	The rank is uncertain due to insufficient information at the state or global level, so more inventories are needed. When no rank has been proposed the global rank may be "G?" or "G5T?"

When ranks are somewhat uncertain or the species' status appears to fall between two ranks, the ranks may be combined. For example:

G4G5	The species may be globally secure (G5), but appears to be at some risk (G4).
G5T2T3	The species is globally secure (G5), but the sub-species is somewhat imperiled (T2T3).
G4?Q	The species appears to be relatively secure (G4), but more information is needed to confirm this (?). Further, there are questions or problems with the species' taxonomy (Q).
G3G4Q S1S2	The species is globally uncommon (G3G4), and there are questions about its taxonomy (Q). In New Hampshire, the species is very imperiled (S1S2).

Appendix 2. Floodplain forest communities in New Hampshire.

Floodplain forests of major rivers

Silver maple floodplain forests

Silver maple/wood nettle-ostrich fern floodplain forest (S2)

Silver maple/false nettle-wood reed-sedge floodplain forest (S2)

Sugar maple floodplain forests

Sugar maple/ironwood/short husk floodplain forest (S1)

Sugar maple-silver maple-white ash floodplain forest (S1S2)

Floodplain and terrace forests of minor rivers

Swamp white oak floodplain forest (S1)

Basswood-white ash-black maple floodplain forest (S1)

Rich sugar maple-ash-oak-hickory forest (S1)

Red maple floodplain forest (S2S3)

Balsam fir floodplain forest (S2)

Sycamore floodplain forest (S1)

Low hemlock-hardwood/cinnamon fern forest (S4?)